Energy-Efficient Dynamic Motion Control for Wheeled Mobile Robots Using Low Cost Resources

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Abstract

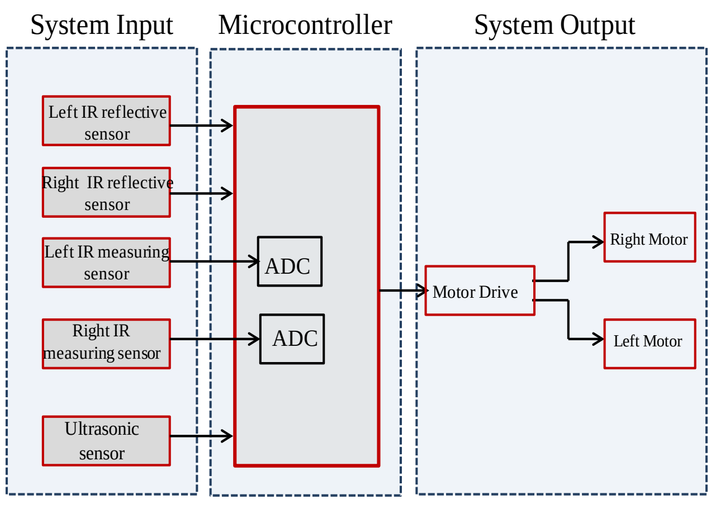
Mobile robotic systems have gained significant attention in human interest, where they represent such a complex interaction with challenging environments. Some applications require continuous operations, so the robots motions have to be optimized to reduce their energy consumption. In addition, total energy consumption in mobile robotic applications is one of the most important issues that has not been adequately considered. Mobile robots are limited by the amount of energy supplied by the batteries they carry where a new supply of energy while working is too expensive to be realistic. Thus, this work aiming to minimize the energy consumption of a wheeled mobile robot in dynamic environments.

Introduction

Mobile robotic systems have significant growth in human welfare, where they represent such a complex interaction of high computational processes, outstanding mechanical design, and exceptional hardware. Majority of mobile robot applications are developed to perform some operations that require an extended level of autonomy such as security and exploration, search and rescue, inspection, etc.

Minimizing energy utilization of mobile robots can be achieved in multiple directions. For example, controlling the robot's velocity, using energy-efficient modules and performing simple calculations can reduce the total energy loss on mobile robots.

Functional Block Diagram

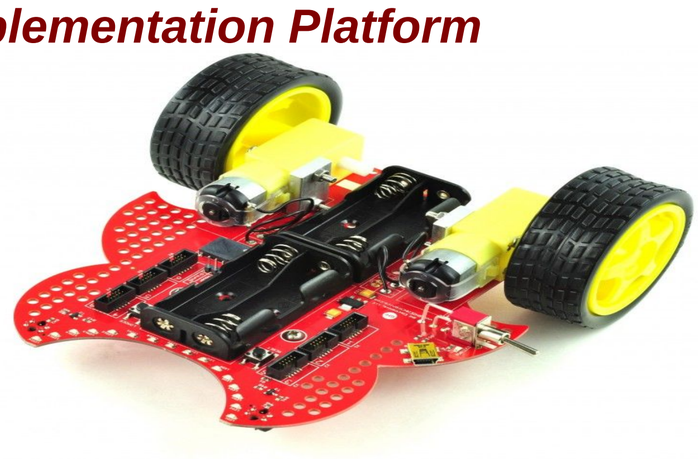


Infrared Reflective Sensors

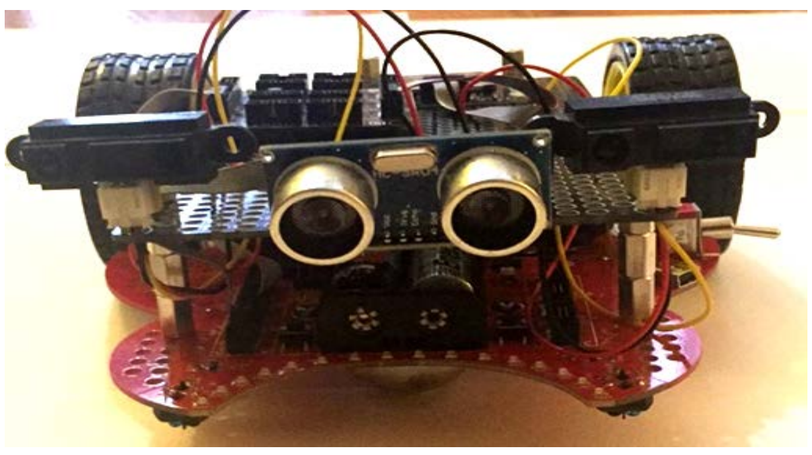
Infrared Measuring Sensors:

Ultrasonic Sensor

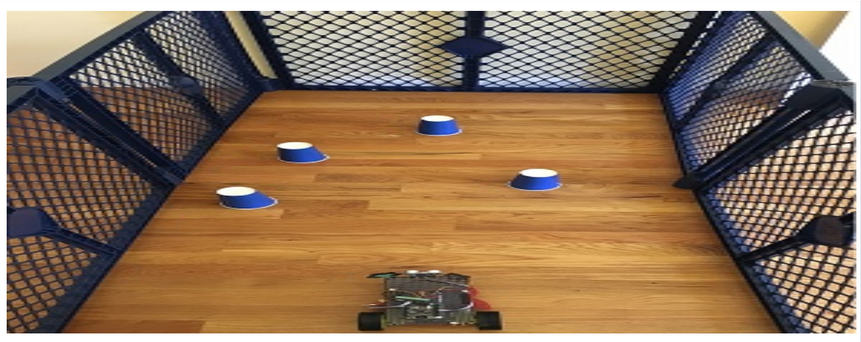
Implementation Platform

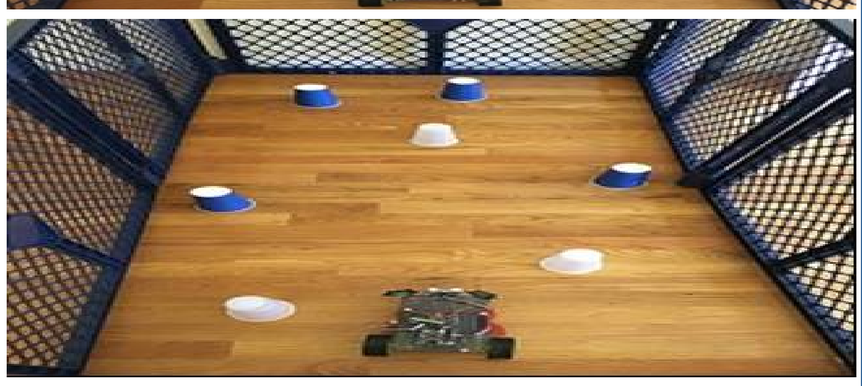


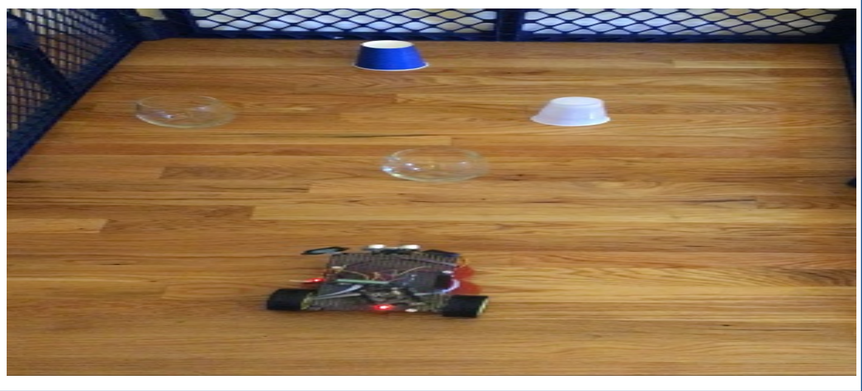
The FEZ Cerbot robot



Test-bed prototype of the proposed model

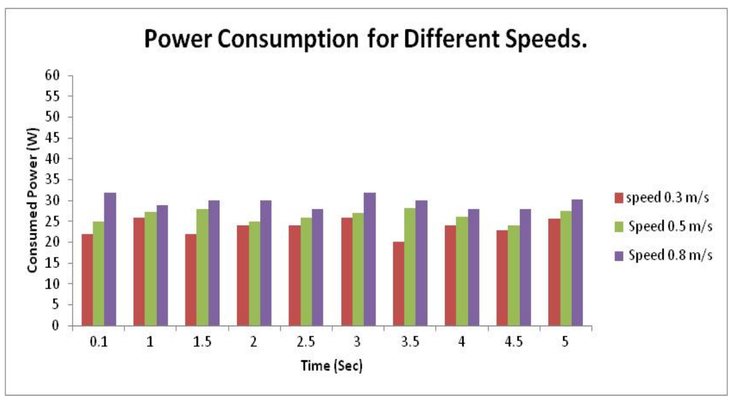


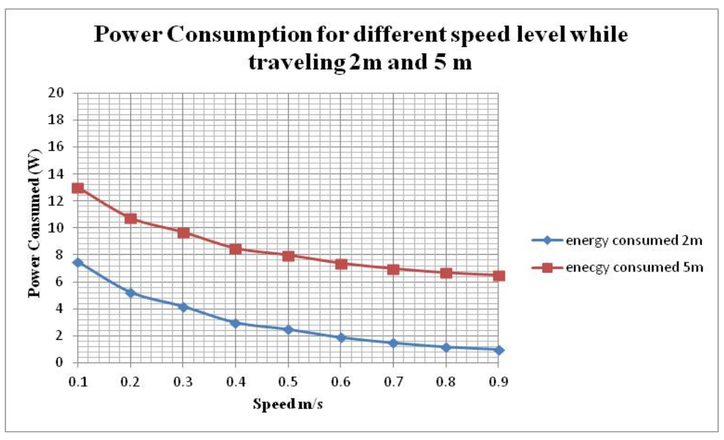




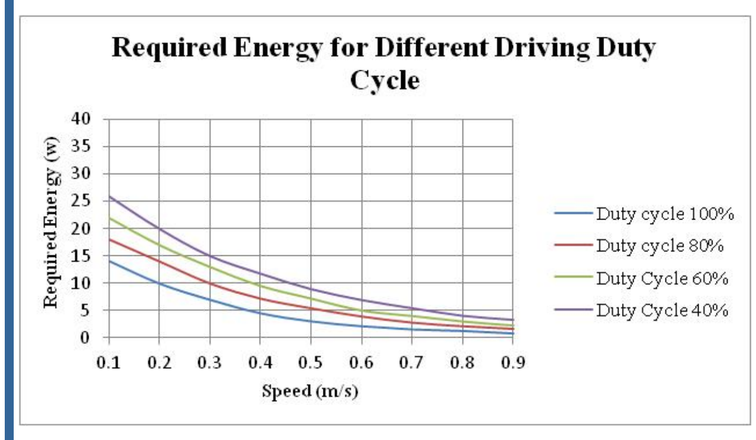
Energy Consumption analysis

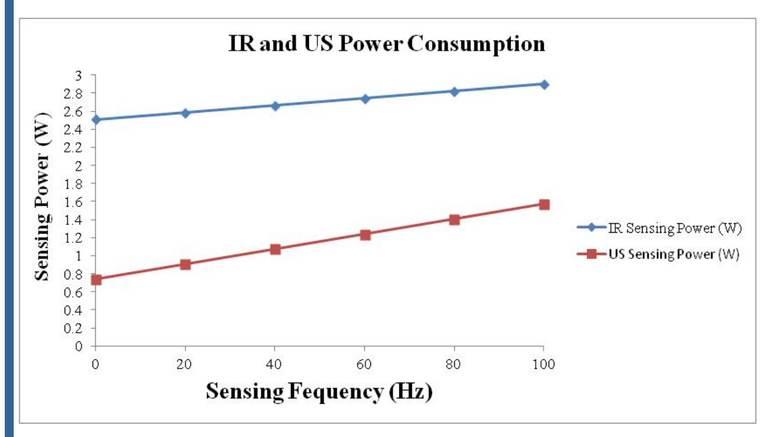
Motional Energy Analysis



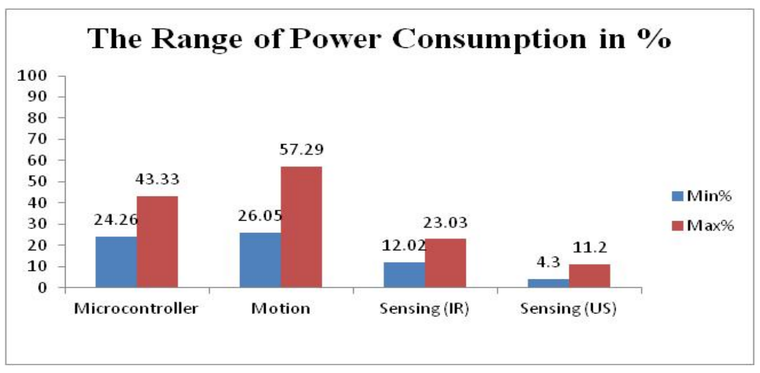


Operational Energy Analysis





Total Power Consumption



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